ZIPPER END SEALING

The present invention relates to reclosable fasteners of the type known as "zippers". These consist of first and second lengths of material, usually plastics, which are shaped to engage with each other along their lengths and can be released from engagement and repeatedly re-engaged and re-released. The zipper can thus form a reclosable fastener for a container, for example a plastics bag. The individual lengths of material making up the zipper are known as "profiles". The profiles can be engaged by pressing them together and released by pulling them apart. Alternatively, the zipper may be fitted with a slider which is moveable along the zipper to cause engagement and release the profiles upon movement of the slider in first and second opposite directions. These zippers are known as "slider zippers". The present invention is applicable to slider and non-slider zippers.

In the production of a reclosable fastener of the kind just mentioned, it is often desired to join the adjacent ends of two profiles to each other. One reason for this is that the joining of the profiles ensures that they are in register for subsequent engagement along their lengths. This is important in a finished plastics bag because the respective panels of the bag to which the profiles are attached may not be perfectly aligned, causing the zipper profiles to become out of register when disengaged. It is also important when the zippers are attached to a web of plastics film material using the technique known as "cross-web technology", in which the zippers are applied to the web at spaced intervals transverse to the longitudinal direction and direction of movement of the web. When such a web is subsequently fed to a form-fill-seal machine on which bags are formed and simultaneously filled, the profiles, if not joined to each other, can become disengaged when they pass over the forming

shoulder of the form-fill-seal machine.

In the past, this joining of the profile lengths has been achieved by various means applied externally of the zipper, including the application of heat, pressure and ultrasonic waves. These means have been applied individually and in combinations.

All these means have the disadvantage that they tend either to damage the zippers being treated, or to result in incomplete or insecure attachment. One reason for this is that the heat, pressure or ultrasonic waves are often applied indirectly to the zippers through a film material to which the zippers are attached, thus making it difficult to apply the heat, etc in the correct quantity. Indirect application also consumes time in a continuous production process.

The present invention aims to overcome, or at least alleviate, these disadvantages.

The present invention provides a method of joining an end of a pair of zipper profiles, the method comprising:

bringing the zipper profiles into engagement with each other at least over an end portion at which the profiles are to be joined;

introducing a heated probe into the engaged end portions of the zipper profiles in order to form a recess in the zipper profile material in the region of the probe;

withdrawing the probe; and

applying external pressure to the end portion of the zipper.

The external pressure deforms the end portions of the profiles and causes the profiles to become fused together as the recess is closed and melted or softened material in its region solidifies or hardens.

Preferably, the pressure is applied in the absence of external heat.

Advantageously, the pressure is applied as the sole external means of joining the profiles.

Conveniently, the probe is introduced into the profile end portions in a direction substantially longitudinally of the profile lengths.

The probe may take the form of a heated pin.

The method of the invention will often be carried out simultaneously on both ends of the pair of zipper profiles.

The present invention also provides an apparatus for joining the ends of a pair of zipper profiles, the apparatus comprising a means for receiving a pair of zipper profile lengths in engagement with each other at least over an end at which the profiles are to be joined, a probe which is movable between a first position in which, in use, it is clear of the engaged profile lengths and a second position in which it has penetrated into the material of the end portions, means for heating the probe, and means for applying external pressure to the zipper profile end portions when the probe is in its second position.

Preferably, the probe is movable between its first and second positions in a direction substantially longitudinally of the profiles.

The apparatus is advantageously provided at both ends of the receiving means for simultaneous treatment of both end of the pair of zipper profiles.

The invention will now be described further by way of example, with reference to the drawing of this specification which shows schematically, in Figures 1 to 5, successive steps in a method of joining the ends of a pair of zipper profiles using an apparatus embodying the invention.

Figure 1 of the drawings shows the end portion of a length of zipper 10 consisting of a first profile 12 and a second profile 14. The profiles are LDPE extrusions.

The profiles 12, 14 are releasably engaged with each other in the condition shown in figure 1. The precise means by which engagement takes place is not shown in detail as it is of no particular relevance to the present invention.

Suffice it however to say that the profiles 12, 14 have interengageable formations which can be brought into engagement with each other by pressing the respective profiles together and can be released from engagement with each other by pulling the profiles apart. Engagement and disengagement can take place repeatedly thereby causing the zipper profile strips to form a reclosable fastener.

In the particular embodiment shown, the second profile 14 is formed with a lateral flange 15 which extends longitudinally of the profile. The first profile 12 has no flange. As shown in figure 1, the profiles 12, 14 are received in a groove 16 which retains the zipper length 10. The groove may be, for example, a groove in the surface of a rotary turret forming part of a machine for applying the zipper lengths to a web of plastics material, for example by using "cross-web technology" as referred to above. Alternatively, the groove 16 may form part of a linear applicator which may also form part of a machine for applying zipper lengths to a web of plastics material using "cross-web technology".

Figure 1 also shows a probe in the form of a pin 18 which is movable back and forth along an axis 20, in directions represented by the double-headed arrow 22 in figure 1, the axis 20 extending longitudinally of the groove 16. The pin 18 has an enlarged rear portion 19 which contains an electrical heating element (not shown), energised by a power supply shown schematically as 24. Suitable drive means shown schematically as 26 are provided for movement of the pin 18 from a first position as shown in figure 1 to a second position which is shown in figure 2.

Figure 1 also shows an element 28 for applying external pressure to the end portion of the zipper 10. For this purpose, the element 28 is movable vertically in directions shown by the double-headed arrow 29. A suitable drive means, shown schematically at 30 is provided for this purpose.

Figure 2 of the drawings shows the pin 18 having moved from its first position to its second position and having penetrated into the end portions of the engaged profile strips 12, 14. The pin rear portion 19, power supply 24 and drive means 26, 30 are omitted from figure 2 and subsequent figures in the interests of clarity.

From the position shown in figure 2, the pin is now withdrawn to its first position, as shown in figure 3 of the drawings. It will be seen, as shown schematically in figure 3, that the pin has caused the formation of a approximately cylindrical recess 32 in the end portions of the zipper, the recess being formed preferably by vaporisation of the material of the zipper profiles 12, 14 but possibly also by melting and/or softening of the zipper material. In any event, a certain amount of melting and/or softening occurs in the vicinity of the recess.

The next step in the process is shown in figure 4, in which the pressure element 28 has been moved by the drive means 30 vertically downwards to deform the zipper end portions and press them together, thus closing the cylindrical recess 30 and joining the zipper profile strips 12, 14 to each other. The strips thus become fused together as the melted or softened material solidifies or hardens.

The final stage in the process is shown in figure 5, in which the pressure element 28 has been raised vertically and the zipper profile lengths 12, 14 remain joined to each other and ready for further use, for example by being applied to the plastics web as part of a bag manufacturing process.

In practice, the apparatus described above may be provided at both ends of the groove 16 for simultaneously joining the profiles at both ends of the zipper lengths. In such an arrangement, the power supply 24 and drive means 26, 30 can be common to the two pins 18.

Although described with reference to a non-slider zipper, the invention is also applicable to slider zippers.